

REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-15, 18, and 19 are currently pending. Claims 16 and 17 have been canceled without prejudice; Claims 18 and 19 have been added; and Claims 1, 2, and 13 have been amended by the present amendment. The changes and additions to the claims are supported by the originally filed specification and do not add new matter.

In the outstanding Office Action, Claims 1-17 were rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement regarding the step of determining a phase of an electric current based on a number and an arrangement of the electrodes.

Applicants respectfully submit that the rejection of Claims 1 and 13 under 35 U.S.C. § 112, first paragraph, is rendered moot by the present amendment to Claims 1 and 13. Claims 1 and 13 have been amended to no longer recite the step of determining a phase of an electric current based on a number and an arrangement of the electrodes.

Amended Claim 1 is directed to a process of reforming a quartz glass crucible, wherein the quartz glass crucible is reformed by an arc discharge generated by electrodes positioned around a rotational axis and configured to heat an inside surface of the crucible while the crucible is rotated, the process comprising: (1) using an electrode structure having 3n electrodes with three-phase alternating electric current, n being equal to or larger than 2, wherein neighboring electrodes are positioned at regular intervals from each other in a ring-like configuration so as to form a stable ring-like arc between the neighboring electrodes, without generating a continuous arc between electrodes facing each other across the central portion of the ring-like configuration; (2) heating the inside surface of the crucible while the crucible is rotated; and (3) removing one of a foreign substance located on the inside surface

and a bubble located under the inside surface. The changes to Claim 1 are supported by the originally filed specification and do not add new matter.¹

Applicants respectfully submit that amended Claim 1 patentably defines over any proper combination of previously cited references, in particular, Japanese Application No. 11-172796 to Honma (hereinafter “the ‘796 patent”); U.S. Patent No. 6,044,667 to Chenoweth (hereinafter “the ‘667 patent”); and U.S. Patent No. 4,531,218 to Williamson (hereinafter “the ‘218 patent”).

The ‘796 patent is directed to a quartz glass crucible for pulling up a silicon single crystal by feeding a powdery quartz raw material into a rotating mold, forming a formed body having a crucible shape, arc melting the formed body to obtain a quartz glass crucible, further mechanically grinding the whole inner surface of the quartz glass crucible, and remelting the inner surface by arc melting or high frequency plasma flame melting.² However, Applicants respectfully submit that the ‘796 patent fails to disclose any description of the structure of the electrodes or the type of power source, i.e., A/C or D/C, or the number of A/C phase when using A/C power. In particular, Applicants respectfully submit that the ‘769 patent fails to disclose using an electrode structure having 3n electrodes with 3-phase alternating electric current, n being equal to or larger than 2, wherein neighboring electrodes are positioned at regular intervals from each other in a ring-like configuration so as to form a stable ring-like arc between the neighboring electrodes, without generating a continuous arc between electrodes facing each other across the central portion of the ring-like configuration, as recited in amended Claim 1.

Further, Applicants respectfully submit that the ‘796 patent fails to disclose heating an inside surface of the crucible while the crucible is rotated so as to reform the quartz glass

¹ See, e.g., page 7, lines 25-30.

² ‘796 patent, Abstract.

crucible, as recited in Claim 1. The '796 patent discloses that the crucible is rotated at the time of making the crucible, but not rotated at the time of remelting an inner surface thereof.

The '667 patent is directed to a system for melting and delivering glass to a work area, such as spinners for making fiberglass including a melter, and a melter for melting glass from batch material to form a pool of molten glass including a bottom wall, inside wall, and at least one discharge port. As shown in Figure 1A, the '667 patent discloses six electrodes equally spaced in a circular pattern around the center of a cylindrical tank. Further, the '667 patent discloses that the plurality of electrodes are arranged within the molten pool so as to generate a "hot spot" of molten glass.

However, Applicants respectfully submit that the '667 patent fails to disclose the step of using an electrode structure having 3n electrodes with 3-phase alternating electric current, n being equal to or larger than 2, wherein neighboring electrodes are positioned at regular intervals from each other in a ring-like configuration so as to form a stable ring-like arc between the neighboring electrodes, without generating a continuous arc between electrodes facing each other across a central portion of the ring-like configuration, as recited in Claim 1. The '667 patent is silent regarding what kind of phase should be used with the six electrodes so as to form a stable ring-like arc without generating the continuous arc between electrodes facing each other, as recited in Claim 1.

Moreover, the '667 patent fails to disclose heating an inside surface of the crucible while the crucible is rotated, as recited in amended Claim 1. In this regard, Applicants note that the '667 application is directed to generating a hot spot to be located away from the sidewall of the furnace in order to prevent wear on the wall, and is unconcerned with generating or forming a stable ring-like arc between neighboring electrodes, without generating a continuous arc between electrodes facing each other.

The '218 patent is directed to a glass melting furnace that includes electrodes arranged in rows of four electrodes across the width of the furnace. For example, as shown in Figure 1, twenty-four electrodes are arranged in groups of four in a row. The '218 patent discloses that a 300 V A/C source is applied to the multiple rows of electrodes via a current limiting controller, but does not include any description of the A/C phase or the combination of A/C phase and the number of electrodes, as recited in Claim 1. In particular, Applicants respectfully submit that the '218 patent fails to disclose the step of using an electrode structure having $3n$ electrodes with 3-phase alternating electric current, n being equal to or larger than 2, wherein neighboring electrodes are positioned at regular intervals from each other in a ring-like configuration so as to form a stable ring-like arc between the neighboring electrodes, without generating a continuous arc between electrodes facing each other across a central portion of the ring-like configuration, as recited in Claim 1. Further, Applicants respectfully submit that the '218 patent fails to disclose the step of heating the inside surface of the crucible while the crucible is rotated, as recited in amended Claim 1.

For the reasons stated above, Applicants respectfully submit that, no matter how the teachings of the '796, '667, and '218 patents are combined, the combination would not teach or suggest using an electrode structure having $3n$ electrodes with 3-phase alternating electric current, n being equal to or larger than 2, wherein neighboring electrodes are positioned at regular intervals from each other in a ring-like configuration so as to form a stable ring-like arc between the neighboring electrodes, without generating a continuous arc between electrodes facing each other across a central portion of the ring-like configuration, as recited in Claim 1.

Independent Claim 13 is also directed to a process of reforming a glass crucible, and also recites the using step recited in Claim 1. Accordingly, Applicants respectfully submit

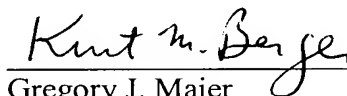
that amended Claim 13 patentably defines over any proper combination of the '796, '667, and '218 patents.

The present amendment also sets forth new Claims 18 and 19 for examination on the merits. New Claims 18 and 19 recite the limitations recited in Claim 1, except that Claim 18 recites 2n electrodes with 2-phase alternating electric current, n being equal to or larger than 2, while new Claim 19 recites 8 electrodes with 4-phase alternating electric current. New Claims 18 and 19 are supported by the originally filed specification and do not add new matter.³ Moreover, for the reasons stated above, Applicants respectfully submit that new Claims 18 and 19 patentably define over any proper combination of the '796, '667, and '218 patents.

Consequently, in view of the present amendment and in light of the above discussion, the outstanding grounds for rejection are believed to have been overcome. The application as amended herewith is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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³ See, e.g., page 8, lines 5-12.